

# Understanding the Organization of Public Health Delivery Systems: An Empirical Typology

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**Context:** Policy discussions about improving the U.S. health care system increasingly recognize the need to strengthen its capacities for delivering public health services. A better understanding of how public health delivery systems are organized across the United States is critical to improvement. To facilitate the development of such evidence, this article presents an empirical method of classifying and comparing public health delivery systems based on key elements of their organizational structure.

**Methods:** This analysis uses data collected through a national longitudinal survey of local public health agencies serving communities with at least 100,000 residents. The survey measured the availability of twenty core public health activities in local communities and the types of organizations contributing to each activity. Cluster analysis differentiated local delivery systems based on the scope of activities delivered, the range of organizations contributing, and the distribution of effort within the system.

**Findings:** Public health delivery systems varied widely in organizational structure, but the observed patterns of variation suggested that systems adhere to one of seven distinct configurations. Systems frequently migrated from one configuration to another over time, with an overall trend toward offering a broader scope of services and engaging a wider range of organizations.

**Conclusions:** Public health delivery systems exhibit important structural differences that may influence their operations and outcomes. The typology developed through this analysis can facilitate comparative studies to identify which delivery system configurations perform best in which contexts.

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PUBLIC HEALTH HAS UNDERGONE A NOTABLE RESURGENCE IN visibility among both policymakers and the public at large. Concerns about gaps in the availability and quality of public health services have grown rapidly in response to both new and persistent health risks, including infectious diseases like SARS and pandemic influenza, the threat of bioterrorism, natural disasters like the 2005 Gulf hurricanes, and the rapid advance of obesity and preventable chronic diseases. Policy discussions about strategies for reforming the U.S. health care system to control costs and improve health outcomes increasingly acknowledge the need to strengthen its capacities for delivering public health services (Levi et al. 2008). These services include an array of activities designed to detect and investigate community health threats, promote healthy lifestyles, prevent disease and injury, prepare for emergencies and disasters, and ensure the quality of water, food, air, and other resources necessary for health (Baker et al. 1994). Unfortunately, studies from the past three decades have found evidence of wide variation in the delivery of these types of services at both the state and local level (IOM 1988; Mays et al. 2004; Turnock and Handler 1997; Turnock et al. 1994). Gaps in the delivery of effective, evidence-based interventions have been found in a wide range of service areas, including nutrition and physical activity programming (Brownson, Ballew, Brown, et al. 2007; Brownson, Ballew, Dieffenderfer et al. 2007; Slater, Powell, and Chaloupka 2007), tobacco control (Mueller et al. 2006), emergency preparedness (Beitsch, Kodoliar et al. 2006; Lurie et al. 2004), food safety, and communicable disease control (Gilbert et al. 2005; Harris 2009).

Analysts often have speculated that an important source of the variation in public health practice observed across states and communities derives from how public health services are organized and delivered (IOM 1988; Scutchfield et al. 2009). In the United States, public health services are delivered through the collective actions of governmental and private organizations, which vary widely in their resources, missions, and operations (Halverson et al. 1996; Mays, Halverson, and Stevens 2001; Mays, Miller, and Halverson 2000). Although governmental public health agencies are central to these delivery systems,

most agencies rely heavily on their abilities to inform, influence, communicate, and collaborate with numerous external organizations that contribute to public health services (Halverson 2002). The range of organizations involved in the delivery of public health and the division of responsibility between governmental and private sectors varies widely across communities (IOM 2002; Mays, Halverson, and Kaluzny 1998a; Mays et al. 2004). The statutorily defined powers and duties of the government's public health agencies differ, as does the extent to which these powers are exercised at the state level or delegated to the local level (Beitsch, Brooks, et al. 2006).

This intricate interorganizational and intergovernmental structure has complicated efforts to conduct comparative studies identifying the strengths and limitations of alternative delivery system configurations (Mays et al. 2009). As the Institute of Medicine (IOM) recently noted, we currently have very little evidence concerning the structure and operation of public health delivery systems (IOM 2002). Consequently, policymakers and administrators have very little information on which to base decisions about the organization of responsibilities and the allocation of resources in public health (Scutchfield et al. 2007). Obtaining a better understanding of delivery system configurations thus is critical to comparative effectiveness research in public health on strategies to improve the availability and quality of public health services.

In other areas of health services, researchers and policy analysts rely on typologies to classify heterogeneous organizations and delivery systems in order to compare performance and outcomes. For example, the typologies of managed care organizations first developed by Harold Luft and refined by others over time have guided a robust body of research on health plans and their effects on health care delivery (Brach et al. 2000; Grembowski et al. 2000; Luft 1981; Weiner and de Lissoy 1993; Welch, Hillman, and Pauly 1990). Similarly, typologies of hospital networks and delivery systems have informed the development of policy and administrative approaches to improving hospitals' quality and efficiency (Bazzoli et al. 1999, 2000; Dubbs et al. 2004; Shortell et al. 2000). Other prominent examples of delivery system typologies are those pertaining to physicians' organizations (Alexander et al. 1996), mental health services (Rosenthal et al. 2006), and community health partnerships (Mays, Halverson, and Kaluzny 1998b; Mitchell and Shortell 2000).

Our article looks at an empirical method of classifying and comparing public health delivery systems that can be used for research, policy, and

practice. We use the Institute of Medicine's definition of a public health delivery system that includes all the governmental and nongovernmental organizations contributing to the delivery of public health services for a defined community (IOM 1988). We define public health services as all the programs, policies, and activities designed to promote a population's health and prevent disease and injury, including activities that identify and investigate health threats, promote healthy lifestyles, prepare for emergencies and disasters, and ensure the quality of water, food, air and other resources necessary for good health (Baker et al. 1994). We focus on those local delivery systems responsible for directly implementing public health services in most communities (DeFries et al. 1981; Halverson et al. 1996).

## Conceptual Framework

Constructs from organizational sociology and industrial organization economics provide a foundation for identifying the structural attributes of complex enterprises like public health delivery systems that are likely to influence their performance and outcomes. Bazzoli and colleagues (1999) identified three general classes of these attributes that apply specifically to multiorganizational health care delivery systems: differentiation, integration, and centralization. With modest adaptations, these attributes also apply to public health delivery systems. *Differentiation* describes the different programs and activities delivered through the system. Highly differentiated public health systems perform a broad array of activities considered to be the core functions of public health (IOM 1988). Less differentiated systems specialize in a narrower scope of these activities. A particular community's specific mix of public health services is likely the result of the interaction of demand-side factors that influence the community's service needs and preferences, as well as the supply-side factors that determine the ability and willingness of organizations to provide these services (Dranove and Satterthwaite 2000; Mays, Halverson, and Kaluzny 1998a; Mays et al. 2000). These factors are population health status and risks, available human and financial resources, prevailing laws and policy priorities, and public and professional expectations of the effectiveness and value of specific public health interventions. Although earlier studies have found wide variation in the activities produced by local public health systems, the sources of

this variation are not clear (Mays et al. 2004, 2006; Mays, Miller, and Halverson 2000; Turnock and Handler 1997; Turnock et al. 1994).

We define a second delivery system attribute, *integration*, as the extent to which services are provided through relationships with other organizations. Highly integrated public health systems rely on many organizational partners to perform public health activities. In many applications, the construct of integration reflects both the number of ties among organizations and the strength of these ties within a system. Tightly integrated relationships may share decision making, financial risk, and/or codependent operations (Alexander et al. 1996; Lorange and Roos 1993). How well a public health system is integrated depends on the density of organizations in the community and their ability and willingness to contribute to public health activities (Mays, Halverson, and Kaluzny 1998a; Zahner 2005). Some activities may offer economic incentives that encourage private-sector organizations to contribute voluntarily, such as the opportunity to gain revenue, reduce costs, or achieve visibility and recognition that convey a political or marketing advantage (Dranove and Satterthwaite 2000; Mays et al. 2000). Some organizations also may have noneconomic motivations to contribute, such as an altruistic mission to improve health and social welfare (Lakdawalla and Philipson 2006). Like other public goods, however, public health activities often do not have enough incentives to ensure that they will be fully provided through private, voluntary action (Carande-Kulis, Getzen, and Thacker 2007). Moreover, noncontributing organizations may benefit from the public health activities performed by others. This free-rider problem arises, for example, in communities where private health insurers save on medical costs because of publicly supported tobacco cessation programs or immunization programs, without contributing proportionately to these efforts (Halverson et al. 1997). A traditional role for governmental public health agencies is to provide beneficial activities not sufficiently covered by private contributors while also stimulating and coordinating the contributions made by other organizations so as to minimize duplication and free-rider problems (IOM 1996). An agency's success here will necessarily influence the integration of the delivery system.

The potential benefits of integration, such as sharing resources and information, may be offset by the coordination problems, transaction costs, and loss of control associated with multiorganizational activities (Lorange and Roos 1993). Empirical studies of integration in public

health suggest that partnerships and coalitions have the advantage of expanding the reach of governmental public health agencies (Roussos and Fawcett 2000; Zahner 2005). Earlier research indicates that a congruent mission facilitates the formation of beneficial public health partnerships, which are more likely among government agencies, nonprofit organizations, and faith-based organizations than among their for-profit counterparts (Halverson, Mays, and Kaluzny 2000; Mays, Halverson, and Kaluzny 1998a; Nelson et al. 1999; Zahner 2005). Health care institutions like hospitals, physicians' practices, and health insurers also are apt to join public health partnerships, particularly those addressing issues requiring both medical and public health interventions such as communicable disease control, chronic disease prevention, and vulnerable populations' access to care (Elster and Callan 2002; Lasker 1997). In the past in most communities, private businesses and employers have rarely formed public health partnerships, but several studies suggest that this involvement has expanded in recent years, particularly regarding such issues as employee health promotion and emergency preparedness (Buehler, Whitney, and Berkelman 2006; Davies 1999; Simon and Fielding 2006).

A third delivery system attribute, *centrality*, reflects the concentration or distribution of responsibility and effort among organizations within the system. Whereas integration indicates the range of organizations participating in the delivery system and the strength of their ties, centrality indicates how public health responsibilities are distributed among these participating organizations. The concept of centralization in public health is often used to describe the "vertical" intergovernmental relationship between a state public health agency and its local government counterparts. In vertically centralized systems, local public health agencies operate under the state agency's direct authority and control, whereas in vertically decentralized systems, local agencies operate independently of the state (DeFries et al. 1981). A broader interpretation of the centrality construct, however, recognizes both vertical and horizontal relationships within a delivery system (Bazzoli et al. 1997; Halverson et al. 1996; Mays, Halverson, and Kaluzny 1998a). In keeping with conventional terminology in public health research and practice, we use the term *centralization* for the distribution of authority between the state and local public health agencies and a related but more general term, *concentration*, for the distribution of authority and effort among all the organizations contributing to local public health services. We use

the local governmental public health agency as the reference point for this construct. In highly concentrated systems, the local public health agency shoulders the bulk of responsibility and effort for delivering public health services within the system. Conversely, in low-concentration (distributed) systems, organizations other than the local public health agency are responsible for much of this effort.

Earlier studies of public health systems focused primarily on vertical centralization between governments rather than on the more general construct of centrality or concentration (Beitsch, Grigg, et al. 2006; DeFries et al. 1981). One theory of political economy suggests that decentralized governmental relationships may provide superior public services because local governments, as opposed to state administrative units, are often more familiar with and more responsive to local community needs (Gordon 1983; Stigler 1957; Tiebout 1956). Other theories maintain that a centralized provision of services may be more effective and efficient because central state governments can coordinate resources and activities across local jurisdictions and thus resolve any spillover effects and inequities in resources across communities (Akin, Hutchinson, and Strumpf 2005). Empirical evidence regarding public health intergovernmental relationships is limited but indicates possible advantages in decentralization (Mays et al. 2004; Wholey, Gregg, and Moscovice 2009).

Organizational theory predicts that public health agencies will pursue differentiation, integration, and concentration within their delivery systems so as to improve the community's health, based on their specific resources, priorities, and incentives (Gillies et al. 1993; Lawrence and Lorsch 1967; Van De Ven, Delbecq, and Koenig 1976). Consequently, we expect to find substantial differences across communities in the structural characteristics of local public health delivery systems, consistent with the diversity of local communities. We also expect that these systems' structural characteristics will evolve over time as organizations improve their performance in the face of changing health risks, market incentives, and policy priorities. Based on these theoretical constructs, this study seeks to (1) determine the variation in public health delivery systems' organizational structures based on the constructs of differentiation, integration, and concentration; (2) classify public health delivery systems into separate, homogenous groups based on their observed structural characteristics; and (3) gauge the extent to which these structural classifications of public health systems change over time. The resulting empirical typology of public health delivery systems provides

a framework for comparing public health systems and finding ways of improving them.

## Methods

We used a longitudinal cohort design to examine variation and change in the organizational characteristics of local public health delivery systems in the United States. Our unit of analysis is the local public health delivery system, which we defined geographically as the service area of one of the nation's nearly 2,900 local governmental public health agencies. Local public health agencies were identified using the National Association of County and City Health Officials (NACCHO) definition: "an administrative or service unit of local or state government that is concerned with health and carries out some responsibility for the health of a jurisdiction smaller than the state" (NACCHO 2006). A total of 2,864 U.S. agencies met this definition as of 2005. Nearly three-quarters of these agencies served an area corresponding to a county or a combined city and county jurisdiction; 16 percent served a city or township jurisdiction; and 10 percent served a multicounty area or region.

### *Study Population*

Our study population covered all local public health delivery systems serving a population of at least 100,000 residents. We limited the study to these large systems because they serve the vast majority of the U.S. population and because they achieve a scale of operations that makes them more directly comparable to one another. Small and rural public health delivery systems are examined in a separate study (Wholey, Gregg, and Moscovice 2009).

NACCHO identified 497 local public health agencies that reported serving jurisdictions of at least 100,000 residents during 1996/1997. These organizations represented approximately 17 percent of all U.S. local agencies but served jurisdictions that contained approximately 70 percent of the total U.S. population. We surveyed these agencies in 1998 and again in 2006 to collect information about the public health delivery system in which they operated. In August 1998, we mailed a



self-administered survey to the director of each agency, plus one additional mailing, two postcard reminders, and two telephone reminders to those agencies that had not responded. Seventy-eight percent of the agencies responded between August and November 1998. We then re-administered the survey to the same agencies during May through August 2006, achieving a 70 percent response rate. The analysis presented in this article covers those agencies reporting data in both time periods. In more than a third of the cases, the individual responding on behalf of the agency changed between 1998 and 2006 owing to leadership turnover, but these changes were not likely to affect the results, because of the survey instrument's interrater reliability (Mays, Miller, and Halverson 2000; Miller et al. 1995). Collectively, the agencies included in this analysis served more than 65 percent of the U.S. population in 2006.

### *Delivery System Measures and Data Sources*

We measured the attributes of local public health delivery systems using the Local Public Health System Assessment instrument developed through a series of research projects sponsored by the U.S. Centers for Disease Control and Prevention (Halverson et al. 1996; Miller et al. 1995; Turnock and Handler 1997; Turnock et al 1994). Using expert panel processes, evidence reviews, case studies, and surveys, these projects identified services and activities regarded as important to protecting and improving communities' public health. The resulting instrument consists of a set of twenty public health activities, each of which was derived from one of the three core public health functions of assessment, policy development, and assurance identified by the Institute of Medicine in 1988 (see table 1).

For each of the twenty activities, the instrument asks local public health agency directors to indicate whether the activity is performed at all in their jurisdiction and, if so, which types of organizations contribute to the activity. The instrument also asks two perception-based questions about each public health activity: (1) what proportion of the activity is contributed by the local public health agency, and (2) how effectively the activity is performed, using a 5-point Likert scale. Earlier validation studies confirmed that the items on the instrument had high face validity as indicators of local public health system performance

TABLE 1  
Local Public Health Activities Examined in the Analysis

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Assessment Activities

1. Community needs assessment process that describes the prevailing health status in the jurisdiction
2. Survey of the population for behavioral risk factors
3. Investigation of adverse health events, including communicable disease outbreaks and environmental health hazards
4. Laboratory services to support investigations of adverse health events and meet routine diagnostic and surveillance needs
5. Analysis of the determinants of and contributing factors to priority health needs, and the population groups most affected
6. Analysis of age-specific participation in preventive and screening services

Policy Development Activities

7. Network of support and communication relationships that includes health-related organizations and the media
8. Activities to inform elected officials about the potential public health impact of decisions under their consideration
9. Process to prioritize community health needs
10. Development of community health action plan with community participation
11. Process to allocate resources in a manner consistent with community health priorities
12. Implementation of community health initiatives consistent with established priorities

Assurance Activities

13. Deployment of resources to address priority health needs
  14. Organizational assessment of the local public health agency
  15. Activities that link people to services that address age-specific priority health needs
  16. Regular evaluations of the effects of public health services on community health status
  17. Use of recognized process and outcome measures to monitor public health programs
  18. Process to provide public information about community health status, needs, behaviors, and policy issues
  19. Reports on community health issues regularly provided to the media
  20. Failure to implement a public health program or service mandated by federal, state, or local law
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*Source:* Turnock, Handler, and Miller 1998.

(Turnock, Handler, and Miller 1998) and that agency directors provided reasonably unbiased information about the activities performed within the jurisdictions served by their agencies (Mays, Miller, and Halverson 2000; Miller et al. 1995).

We used survey responses to construct four types of delivery system measures for each system/jurisdiction. First, we measured differentiation as the proportion of the twenty public health activities performed within the delivery system. Second, we measured integration by calculating the proportion of public health activities contributed by each type of organization in the system and then by computing the average of this proportion across all types of organizations represented in the system. Third, we computed a measure of concentration as the average level of effort contributed by the local public health agency across all activities performed in the jurisdiction. Finally, we calculated a perceived effectiveness measure as the average score on the effectiveness scale across all activities performed in the jurisdiction.

### *Statistical Analysis*

We used hierarchical cluster analysis methods to place local delivery systems into mutually exclusive categories based on the structural measures of differentiation, integration, and concentration. We standardized the three structural measures into z-scores and then grouped the systems into categories, or clusters, based on similarity across the three measures. The stepwise Ward method was used to assign systems to clusters, with a squared Euclidean distance specification used to assess similarity (Ward 1963). We used a visual inspection of the clusters and their distance measures (dendograms) to determine a parsimonious number of well-defined clusters. A seven-cluster solution was found to provide a good fit with the data and produce clusters that were conceptually distinct from one another. We performed the cluster analysis first using data from the 1998 survey and then used Duncan multiple-range tests to determine boundary values of differentiation, integration, and concentration that characterized each cluster. We then repeated the cluster analysis, using data from the 2006 survey and using Euclidean distance centroids from the 1998 survey, to test the reliability and stability of the cluster solutions. The boundary values of the clusters identified in 1998 closely matched the values of the clusters identified in 2006, suggesting

that the method of grouping public health systems was longitudinally consistent. Transition probabilities were calculated for each of the seven clusters in 1998 and 2006 in order to characterize the patterns of change from one system classification to another.

## Results

### *Sample Characteristics*

The delivery systems included in our study showed considerable heterogeneity with respect to community and public health agency characteristics (see table 2). The systems served populations from 100,000 to nearly 10 million residents, with an average size of just under 500,000. Almost all the systems were located in metropolitan areas, with the exception of the 5 percent of systems located in smaller micropolitan areas, defined as the urbanized zones surrounding towns and cities of between 10,000 and 25,000 residents. Racial minority groups, on average, comprised 27 percent of the population served, but racial composition varied widely across the systems, as did socioeconomic status and health resources. The local public health agencies operating within these systems were equally diverse, with expenditures from less than \$1 to nearly \$200 per capita, and staffing levels from 4.5 full-time equivalent (FTE) positions to nearly 250 FTE positions per 100,000 residents. Nearly three-quarters of these agencies operated as decentralized units from their state health agencies.

### *Variation and Change in System Attributes*

Our measures of system differentiation indicated that on average, the scope of activities performed in public health systems increased between 1998 and 2006. Approximately 64 percent of the public health activities we examined, or thirteen of the twenty activities, were performed in the average system in 1998 (see table 3). By 2006, 70 percent of these activities were performed in the average system, an increase equivalent to one additional activity ( $p < 0.05$ ). Assessment activities were somewhat more likely to be performed than policy or assurance activities, but these differences narrowed between 1998 and 2006. Although differentiation increased on average, there was substantial variation across systems in

TABLE 2  
Characteristics of Communities and Local Public Health Systems, 2006

Variable (Scale)	Mean	Std. Dv.	Min.	Max.
<b>I. Community Characteristics</b>				
Population size (1000s)	496.38	967.63	100.32	9,998.37
Nonwhite race (%)	27.24	16.97	4.03	81.77
Age 65 years and older (%)	12.04	3.65	4.55	28.96
Below poverty level (%)	10.73	3.93	2.95	27.77
Non-English speaking (%)	2.45	2.78	0.32	18.87
Completed college degree (%)	24.74	9.13	8.40	54.56
Income per capita (\$1000s)	30.70	7.81	9.32	84.04
Active physicians per 100,000 residents	267.05	200.25	27.19	1,598.09
Hospital beds per 100,000 residents	292.78	183.07	0.00	1,613.85
Metropolitan area (0, 1)	0.95	0.21	0.00	1.00
Micropolitan area (0, 1)	0.05	0.21	0.00	1.00
<b>II. Local Public Health Agency Characteristics</b>				
Expenditures per capita (\$)	41.85	30.13	0.80	198.58
Revenue from clinical services (%)	13.09	12.31	0.00	64.00
Staff FTE per 100,000 residents	54.22	35.11	4.48	247.98
Governed by local board of health (0, 1)	0.72	0.45	0.00	1.00
Type of public health jurisdiction (0, 1)				
County	0.60	0.32	0.00	1.00
City or township	0.07	0.26	0.00	1.00
Combined city and county	0.16	0.37	0.00	1.00
Multicounty/special district	0.17	0.37	0.00	1.00
Administrative relationship with state agency (0, 1)				
Decentralized local control	0.73	0.21	0.00	1.00
Centralized state control	0.13	0.33	0.00	1.00
Shared control	0.14	0.35	0.00	1.00

the direction and magnitude of change, with 41 percent of systems reporting a reduction in the scope of activities performed between 1998 and 2006.

Our measures of system integration showed that the breadth of organizations contributing to public health activities increased moderately between 1998 and 2006. Large majorities of local public health systems

TABLE 3  
Measures of System Differentiation, Integration, Concentration, and Perceived Effectiveness, 1998 and 2006

Variable	1998		2006		Signif.
	Mean/ Pct.	Std. Dv.	Mean/ Pct.	Std. Dv.	
I. Differentiation: Proportion of Public Health Activities Performed in the Jurisdiction (Mean)					
Assessment activities	0.67	0.22	0.74	0.20	*
Policy activities	0.60	0.28	0.68	0.26	*
Assurance activities	0.64	0.22	0.69	0.20	
All activities	0.64	0.19	0.70	0.18	*
II. Integration: Proportion of Systems That Include Contributions from the Following Types of Organizations					
State agencies	0.98		0.99		
Local agencies (excluding LPHA <sup>a</sup> )	0.92		0.97		
Federal agencies	0.44		0.61		*
Hospitals	0.97		1.00		
Physicians' organizations	0.85		0.93		
Community health centers	0.51		0.84		*
Health insurers	0.45		0.53		**
Other nonprofit organizations	0.95		0.95		
Educational institutions	0.66		0.78		*
Other	0.77		0.77		
III. Integration: Proportion of Public Health Activities Contributed by Each Type of Organization (Mean)					
State agencies	0.37	0.21	0.47	0.21	*
Local agencies (excluding LPHA <sup>a</sup> )	0.32	0.22	0.51	0.25	*
Federal agencies	0.07	0.12	0.12	0.15	
Hospitals	0.37	0.21	0.41	0.19	
Physicians' organizations	0.20	0.18	0.24	0.18	
Community health centers	0.12	0.18	0.29	0.22	*
Health insurers	0.09	0.14	0.10	0.14	
Other nonprofit organizations	0.32	0.20	0.34	0.20	
Educational institutions	0.16	0.18	0.22	0.20	
Other	0.09	0.14	0.09	0.14	
IV. Concentration: Proportion of Effort Contributed by Local Public Health Agency (Mean)					
Assessment activities	0.38	0.18	0.40	0.15	
Policy activities	0.34	0.19	0.39	0.18	**
Assurance activities	0.40	0.21	0.40	0.19	
All activities	0.38	0.16	0.40	0.14	

TABLE 3—Continued

Variable	1998		2006		Signif.
	Mean/ Pct.	Std. Dv.	Mean/ Pct.	Std. Dv.	
V. Perceived Effectiveness: Extent to Which Need for Activity Is Fully Met (Mean)					
Assessment activities	0.41	0.15	0.52	0.17	*
Policy activities	0.27	0.17	0.42	0.20	*
Assurance activities	0.38	0.16	0.41	0.20	*
All activities	0.35	0.13	0.45	0.16	*

Notes: \*Difference between 1998 and 2006 is significant at  $p < 0.05$ .

\*\*Difference between 1998 and 2006 is significant at  $p < 0.10$

<sup>a</sup>This organizational category excludes the designated local public health agency (LPHA).

reported contributions by state and local government agencies, hospitals, and community-based organizations in both time periods. The largest increases in contributions to at least one activity were observed for community health centers, federal agencies, and educational institutions. Community health centers, for example, contributed to one or more public health activities in 84 percent of the systems in 2006, up from 51 percent in 1998. The largest increases in the scope of activities contributed were observed for local and state government agencies and community health centers. Local government agencies (excluding the local public health agency) contributed to 51 percent of the public health activities performed in the average system in 2006, up from 32 percent in 1998, an increase equivalent to contributions in three additional activities.

Measures of concentration remained relatively stable on average across the eight-year period of study. Local public health agencies were reported to contribute an average of 40 percent of the total effort expended to perform public health activities in 2006, statistically unchanged from the 38 percent effort reported in 1998. The change in this measure, however, varied considerably across systems. The concentration of effort declined in nearly half the systems, with an average reduction of 10 percentage points.

Measures of perceived effectiveness centered on the lower half of the scale but rose significantly between 1998 and 2006 (table 3). The average effectiveness rating across all systems was 45 percent of the

maximum possible score in 2006, up from 35 percent in 1998 ( $p < 0.05$ ). The largest increases in perceived effectiveness were reported for policy activities and assessment activities, with assurance activities remaining statistically unchanged. The perceived level of effectiveness was lower in 2006 than in 1998 for less than 30 percent of systems.

### *System Configurations*

The cluster analysis of the system measures revealed seven distinct organizational configurations for public health delivery systems, which could be grouped into three tiers based on their level of differentiation. Three of the seven system configurations were identified as highly differentiated, meaning that they offered a broad and encompassing scope of activities (see table 4). These systems generally performed more than two-thirds of the activities in each of the three Institute of Medicine (IOM) domains of assessment, policy development, and assurance. As such, these systems were labeled *comprehensive* in their scope of activities. Another two system configurations were identified as moderately differentiated because they performed about half the activities in each IOM domain. These systems were labeled *conventional* in differentiation because they aligned closely with the average scope of services performed in local communities. The final two system configurations performed a relatively narrow scope of activities and therefore were labeled *limited* in differentiation. The attributes of each configuration are summarized in table 4 and detailed later.

#### *Comprehensive Systems*

Configuration 1: Concentrated Comprehensive Systems. Systems in this first group performed a broad scope of public health activities and involved a wide range of organizations, with the governmental public health agency shouldering much of the effort. Accordingly, these systems appeared both highly integrated and highly concentrated in structure. Although many different organizations helped deliver public health services, the governmental agency assumed most of the responsibility and effort. In these systems, governmental agencies tended to partner with other organizations, primarily through low-effort mechanisms like advisory committees and planning groups that required relatively little



TABLE 4  
Characteristics of Local Public Health System Configurations

Configuration Type and Description	Prevalence		Perceived Effectiveness
	1998	2006	Mean (95% CI)
Tier I: Highly Differentiated Systems			
1. Concentrated Comprehensive System Broad scope of activities performed. Wide range of organizations contribute. Local public health agency shoulders much of the effort in performing activities.	12.5%	21.4%	0.63 (0.59, 0.67)
2. Distributed Comprehensive System Broad scope of activities performed. Wide range of organizations contribute. Effort in performing activities is distributed across participating organizations.	5.1%	3.9%	0.61 (0.54, 0.68)
3. Independent Comprehensive System Broad scope of activities performed. Narrow range of organizations contribute. Local public health agency shoulders much of the effort in performing activities.	6.6%	11.6%	0.52 (0.47, 0.56)
Tier II. Moderately Differentiated Systems			
4. Concentrated Conventional System Moderate scope of activities performed. Moderate range of organizations contribute. Local public health agency shoulders much of the effort in performing activities. Highly transitory system.	3.4%	3.0%	0.43 (0.33, 0.54)
5. Distributed Conventional System Moderate scope of activities performed. Moderate range of organizations contribute. Effort in performing activities is distributed across participating organizations. Most prevalent configuration.	46.7%	30.9%	0.30 (0.28, 0.33)
Tier III. Limited-Differentiation Systems			
6. Concentrated Limited System Narrow scope of activities performed. Limited range of organizations contribute. Local public health agency shoulders much of the effort in performing activities.	12.3%	18.0%	0.41 (0.38, 0.44)
7. Distributed Limited System Narrow scope of activities performed. Moderate range of organizations contribute. Effort in performing activities is distributed across participating organizations.	13.4%	11.2%	0.45 (0.42, 0.49)

investment in resources. Approximately 21 percent of the nation's large public health systems fell into this category in 2006, up from 13 percent in 1998.

**Configuration 2: Distributed Comprehensive Systems.** A second group of public health systems provided a broad scope of public health activities and involved a wide range of organizational partners. These systems differed from the first system configuration in that the effort expended in delivering public health activities was less concentrated in the governmental public health agency and more widely distributed across organizational partners. This category represented approximately 4 percent of the local public health systems studied in 2006, down slightly from 5 percent in 1998.

**Configuration 3: Independent Comprehensive Systems.** A third category of systems performed a broad scope of services but involved a relatively narrow range of organizations in their delivery. Like configuration 1, these systems relied on the governmental public health agency to provide much of the effort in performing public health services. These systems tended to serve relatively small communities with a limited supply of physicians, hospitals, and other organizational resources. This category represented approximately 12 percent of the systems studied in 2006, up from 7 percent in 1998.

### *Conventional Systems*

**Configuration 4: Concentrated Conventional Systems.** Two categories of local public health systems were classified as moderately differentiated, or *conventional*, based on delivering an intermediate scope of services. The smallest category of conventional systems relied on the governmental public health agency to provide much of the effort in performing public health services. These systems were accordingly classified as concentrated in structure. These systems represented less than 5 percent of systems in both 1998 and 2006. Moreover, this group of systems appeared highly transitory in nature, with all the systems of this type in 1998 moving to a different configuration by 2006. Most of the systems migrating out of this category did so by either expanding their scope of services to become an independent comprehensive system (configuration 3) or narrowing their scope of services to become a concentrated limited system (configuration 6).

Configuration 5: Distributed Conventional Systems. The second group of conventional public health systems was the most prevalent type of system identified in the analysis. These systems provided an intermediate scope of public health services and distributed the effort of performing these services across various contributing organizations. Generally fewer organizations were involved in delivering public health services than was the case among comprehensive systems. This category represented approximately 31 percent of public health systems in 2006, down from 47 percent in 1998.

### *Limited Systems*

Configuration 6: Concentrated Limited Systems. The final two categories of local public health systems were classified as limited in differentiation based on their relatively narrow scope of public health activities. The systems in configuration 6 covered relatively few organizations in the delivery of public health services, and they relied heavily on the governmental public health agency to provide much of the effort. These concentrated systems accounted for 18 percent of public health systems in 2006, up from 12 percent in 1998.

Configuration 7: Distributed Limited Systems. The systems in configuration 7 used somewhat more organizations in the delivery of public health services compared with configuration 6, and they distributed more of the effort among these contributing organizations. Likewise, the proportion of effort contributed by the governmental public health agency was generally lower in these systems than in more concentrated systems. Approximately 11 percent of the public health systems were classified into this category in 2006, down slightly from 13 percent in 1998.

### *Perceived Effectiveness and System Configurations*

The ratings of the perceived effectiveness of public health activities were significantly higher in comprehensive public health systems (configurations 1 through 3) compared with those in other types of systems (table 4). Among comprehensive systems, the average effectiveness ratings were highest for integrated systems (configurations 1 and 2,

58 percent) and somewhat lower for independent systems (configuration 3, 45 percent). The lowest effectiveness ratings were reported in conventional systems (configurations 4 and 5), whose ratings averaged less than 30 percent. By contrast, the perceived effectiveness of the limited systems (configurations 6 and 7) ranged from 38 to 41 percent. These differences in perceived effectiveness across system configurations remained statistically significant after adjusting for population demographics, socioeconomic status, and community health resources.

### *Transitions in System Configurations*

The local public health systems included in each type of configuration changed substantially between 1998 and 2006 (see table 5), indicating a high degree of structural fluidity during this time period. Transition probabilities indicated that the concentrated comprehensive systems (configuration 1) were the most stable over time, so that 50 percent of the systems in this category in 1998 remained in it in 2006. Of the remainder, more than half these systems moved into a limited-differentiation system (configurations 6 and 7) by 2006. Among the distributed comprehensive systems (configuration 2), more than 40 percent remained in one of the highly differentiated configurations as of 2006, but a third of these systems shifted to a moderately differentiated system (configuration 5), and another 25 percent moved to a limited-differentiation system. Only 15 percent of the independent comprehensive systems (configuration 3) remained in a highly differentiated category by 2006, while most of these systems moved to a moderately differentiated structure.

As noted previously, the concentrated conventional systems (configuration 4) appeared highly transitory in structure, and all the systems in this category in 1998 shifted to a different structure by 2006. Most of these systems appeared to move either by (1) distributing more of their effort to other organizations within the system (configuration 5) or (2) narrowing the scope of activities performed within the system (configuration 6). The distributed conventional systems (configuration 5) remained the most prevalent type of system throughout the period of study and proved to be the second-most stable type of system after configuration 1. More than a third of the systems in this category as of 1998 were still in this category in 2006; another third moved to a

TABLE 5  
Transition Probabilities for Local Public Health System Configurations, 1998 to 2006

	1998 Configurations						
	High Differentiation			Moderate Differentiation		Limited Differentiation	
	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6	Cluster 7
	(n = 30)	(n = 12)	(n = 13)	(n = 7)	(n = 105)	(n = 32)	(n = 32)
Cluster 1 (n = 49)	50.0	16.7	0.0	14.3	13.3	28.1	25.0
Cluster 2 (n = 8)	3.3	8.3	0.0	0.0	3.8	3.1	3.1
Cluster 3 (n = 27)	6.7	16.7	15.4	0.0	9.5	21.9	12.5
Cluster 4 (n = 7)	0.0	0.0	7.7	0.0	4.8	3.1	0.0
Cluster 5 (n = 72)	13.3	33.3	46.2	42.9	37.1	25.0	25.0
Cluster 6 (n = 42)	13.3	8.3	15.4	42.9	22.9	9.4	15.6
Cluster 7 (n = 26)	13.3	16.7	15.4	0.0	8.6	9.4	18.8
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Note: Probabilities are scaled to range from 0 to 100.

limited-differentiation system; and more than 25 percent moved to a highly differentiated system.

The limited-differentiation systems in 1998 frequently shifted to structures with higher differentiation by 2006. Nearly half these systems moved into one of the highly differentiated categories by 2006 (configurations 1 through 3), and another 25 percent of these systems adopted a distributed conventional structure (configuration 5).

## Discussion

This analysis confirms that local public health delivery systems vary widely in their organization and scope of activity, but it contradicts the often-cited anecdote that “if you’ve seen one health department, you’ve seen one health department.” Rather, the patterns of variation we found suggest that systems cluster around a few different structural configurations. Three of these configurations deliver a highly differentiated scope of public health activities, and thus they may be preferred to other models on the basis of their comprehensiveness. Moreover, the three comprehensive configurations are perceived to perform public health activities more effectively than other types of systems, an advantage that is particularly pronounced for comprehensive systems with high levels of integration. Taken together, our findings suggest that multiple organizational configurations support a broad and diversified scope of public health activities. One of these configurations relies heavily on the work of governmental public health agencies, while two other configurations delegate considerable responsibility to other organizations. The optimal structure for a particular community is likely to hinge on local circumstances that shape the ability and willingness of other organizations to engage in public health activities.

The correspondence between differentiation and perceived effectiveness was not uniform across the seven public health system configurations identified in this study. Instead, we found a U-shaped relationship between these two constructs, with the lowest ratings of effectiveness occurring not among the least differentiated systems but among the conventional systems that delivered an intermediate scope of activities. One explanation for this finding is that limited systems concentrate their efforts on a relatively narrow range of high-priority public health activities, thereby bolstering their effectiveness. This form of specialization

may offer advantages to communities with few human, financial, and organizational resources (Skinner 1974).

Our findings also suggest that the organizational structures of public health delivery systems are much more dynamic than is commonly recognized. Public health agencies are often perceived as bureaucratic and administratively inflexible organizations, because of the tightly controlled personnel systems, funding mechanisms, and purchasing and contracting rules frequently found in local and state governments (Mays, Miller, and Halverson 2000). Despite these constraints, the delivery systems in which these agencies operate changed significantly over the eight-year period of this study, with an overall trend toward offering a broader scope of services and engaging a wider range of organizations. These changes may reflect the efforts of public health agencies to use external relationships to compensate for their own organizations' administrative and financial constraints (Iacobucci and Zerrillo 1997). The structural changes we observed may also reflect the complex array of epidemiological, economic, political, and policy shifts that occurred over the eight-year study period. Heightened concerns about bioterrorism and emerging infectious diseases, increased awareness of the obesity epidemic and related chronic disease risks, new federal and state funding for public health infrastructure development, and implementation of federal and state performance standards and performance measurement systems for public health agencies are just a few of the events occurring over this period that may have precipitated and enabled delivery system changes. Overall, the frequency and types of structural change observed in this study suggest that public health delivery systems are highly adaptable enterprises. Developing a better understanding of the causes and consequences of these changes represents an important area for future research.

Our analysis did not attempt to identify an optimal organizational configuration for public health delivery systems, nor did it identify the circumstances in which a given configuration would perform best. Understanding how delivery systems are shaped by their demographic, socioeconomic, institutional, and political environments remains an important area of inquiry. The delivery system typology we identified through this analysis provides a starting point for conducting the comparative research needed to produce these types of evidence. Researchers can use the typology to compare the adoption, implementation, and impact of public health interventions in different types of delivery systems,

thereby adding to the evidence regarding which public health practices work best in which types of settings and why. Structural measures from the typology can serve as the dependent variables of interest for studying the effects of exogenous policy changes, economic shocks, or organizational reconfigurations on public health delivery systems. Similarly, the typology measures can serve as the primary independent variables of interest for determining any systematic differences in quality and efficiency across various types of local public health systems. Collectively, these types of studies will provide a clearer understanding of the relative strengths and weaknesses of different approaches to organizing and delivering public health services, along with the political, economic, and institutional contexts in which these approaches appear to function best.

Along with its research applications, the typology developed through this study can be used by policymakers and public health administrators to decide which service delivery models may be the most feasible and desirable in their state or community, given the current and potential organizational participants in their systems. By moving the typology from less differentiated to more differentiated structural models, decision makers can chart a path of structural change toward more comprehensive service delivery. In addition, administrators can use the typology to identify “peer groups” of similarly structured local public health systems that may be appropriate for benchmarking, networking, and quality improvement projects. The typology also can provide the foundation for classifying systems into relatively homogenous groupings to judge performance and monitor programs. In these ways, the typology directly responds to the IOM’s recent call for research that can be used to guide policy decisions that shape public health practice (IOM 2002).

We should note that the typology developed from this analysis was derived from the study of the nation’s largest public health delivery systems, those serving populations of at least 100,000 residents. The extent to which these system attributes apply to smaller communities is not known and should be the subject of future study. Although the vast majority of U.S. residents live in the large communities included in this study, most public health systems serve communities of fewer than 100,000 residents. This situation creates a need for public health policymakers and practitioners to understand the structural attributes of both large and small systems. Moreover, our typology does not include all the structural characteristics likely to be important to understanding the



organization and operation of local public health activities. In particular, this typology does not account for some of the more commonly described characteristics of governmental public health agencies, such as those related to financing, workforce, and governance models (Beitsch, Brooks, et al. 2006; NACCHO 2006). Accordingly, this typology complements and extends the more conventional ways of describing public health agencies, and it can be used in combination with these agency descriptors to evaluate public health service delivery.

As with other delivery system typologies developed for the health sector, it will be important to refine and enhance this typology by applying it to new data on public health systems and by developing refined measures of core structural dimensions. For example, applying the typology to a single state may permit access to more detailed data on organizational characteristics, creating opportunities for refinement. Another important extension would be to apply the typology framework to state-level public health systems by developing structural measures at that geopolitical level. Likewise, the typology should be extended to examine structural variation across specific domains of public health activity—such as public health preparedness, chronic disease prevention, and environmental health—as suggested by recent research in small and rural public health systems (Wholey, Gregg, and Moscovice 2009). These directions for further development will help fill important conceptual and methodological gaps in comparative research on public health systems, thereby enabling progress toward evidence-based decision making.

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